

The Research Activities Related to Disertation and Recent Projects

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Content

- Dissertation
- Subject
- Methods
- Results
- Wheel-rail interface research
- Introduction
- Lubrication
- Sanding



Dissertation

Subject of dissertation

- Study of Elastohydrodynamic Film Formation in Hypoid Gears.

Aim of the study

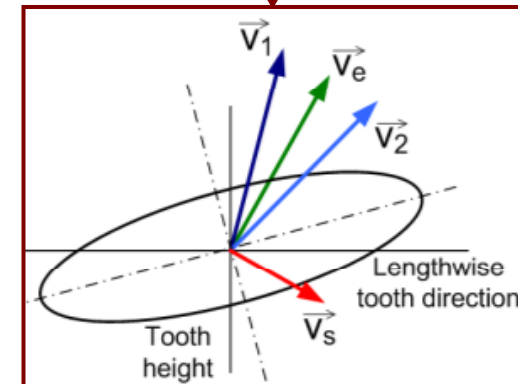
- To describe the behavior of the lubricating film in a simulated ball/roller – disk contact under the conditions occurring in hypoid gear and to generalize the results.

The question

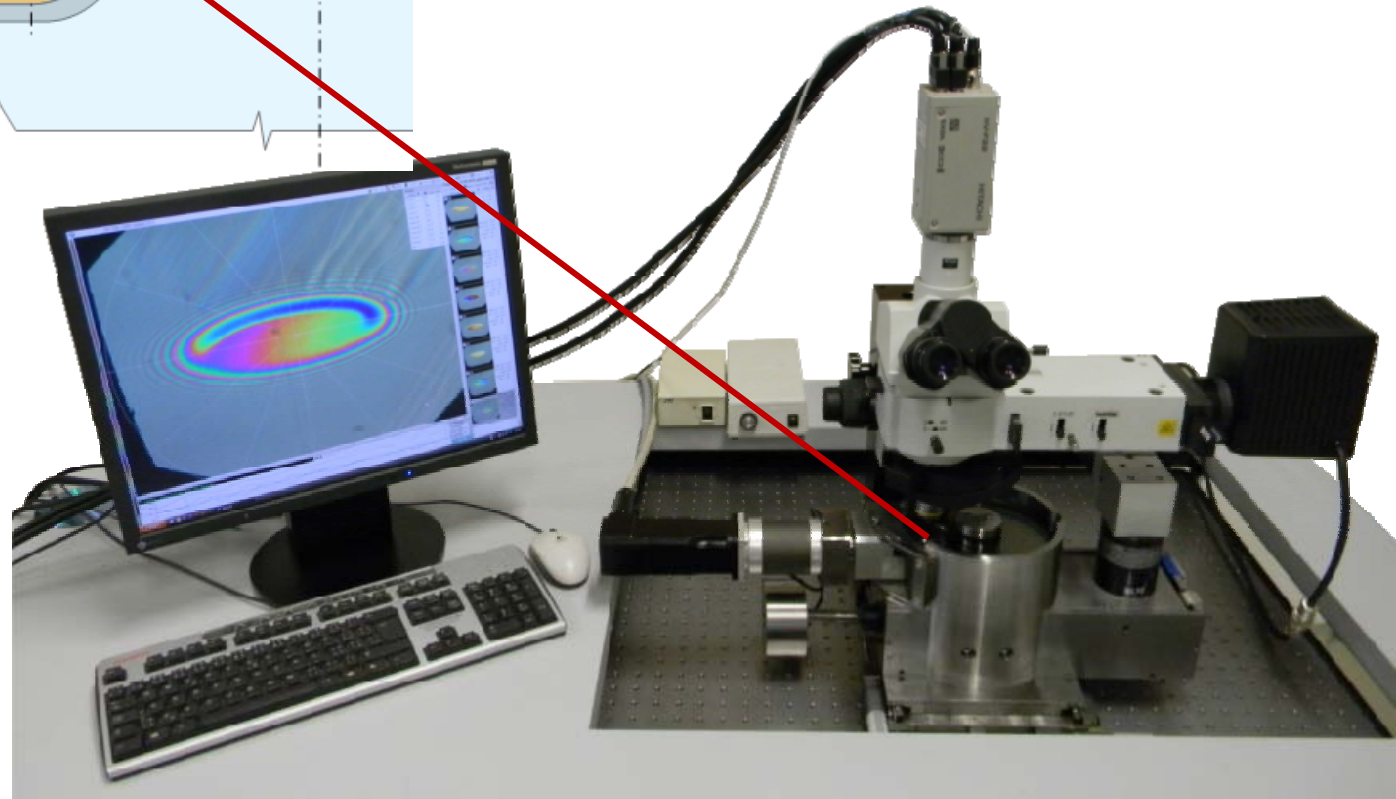
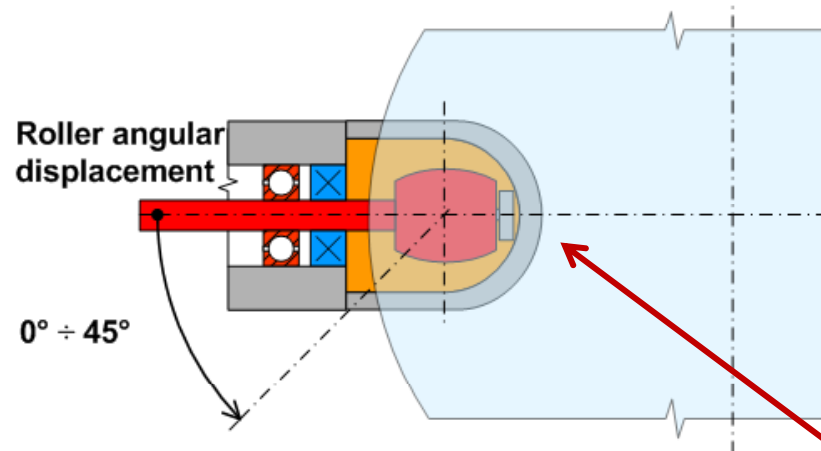
- What is the effect of different orientation of surface velocities on the distribution of EHL film thickness?

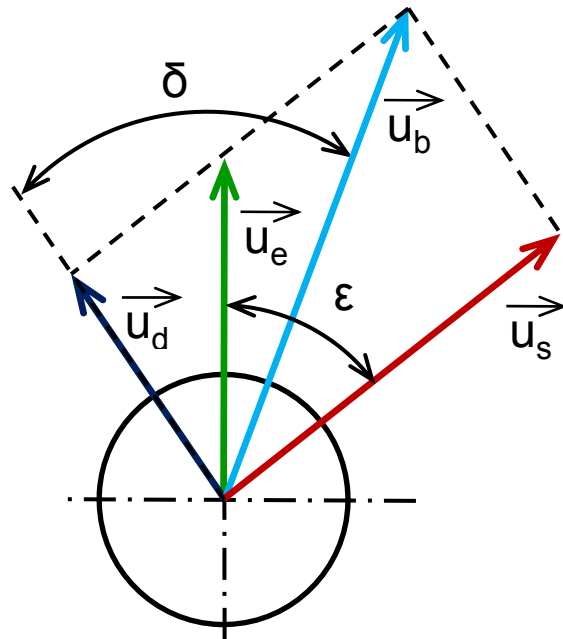
Working hypothesis

- Sliding velocity contributes to the reduction of film thickness.
- It's orientation has no effect on film thickness.



Dissertation - apparatus





Entrainment velocity:

$$\vec{u}_e = \frac{\vec{u}_1 + \vec{u}_2}{2}$$

Sliding velocity:

$$\vec{u}_s = \vec{u}_1 - \vec{u}_2$$

Input parameters

- $|u_b|$
- $|u_d|$
- δ

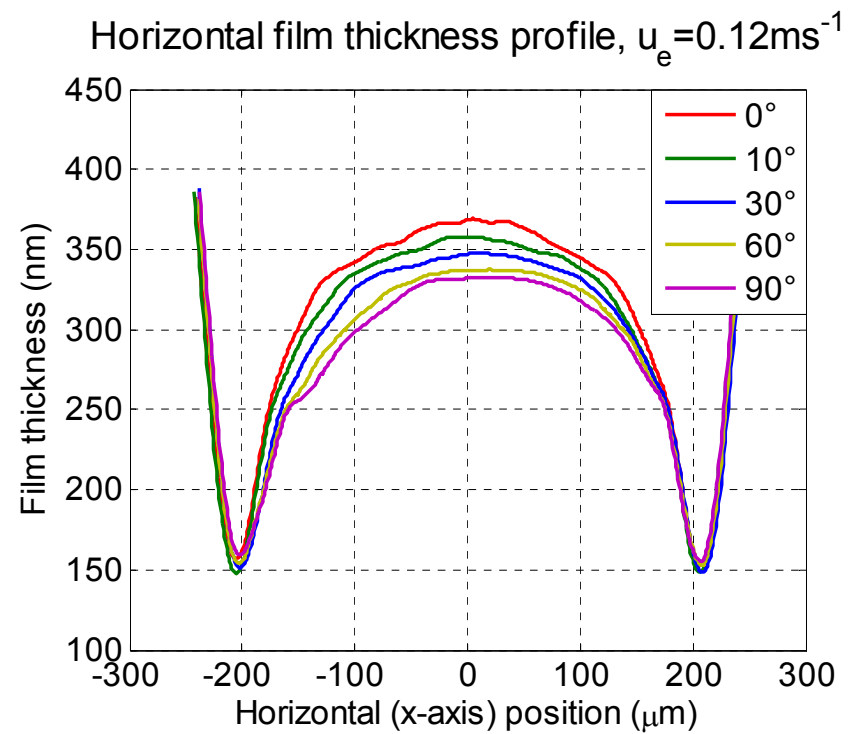
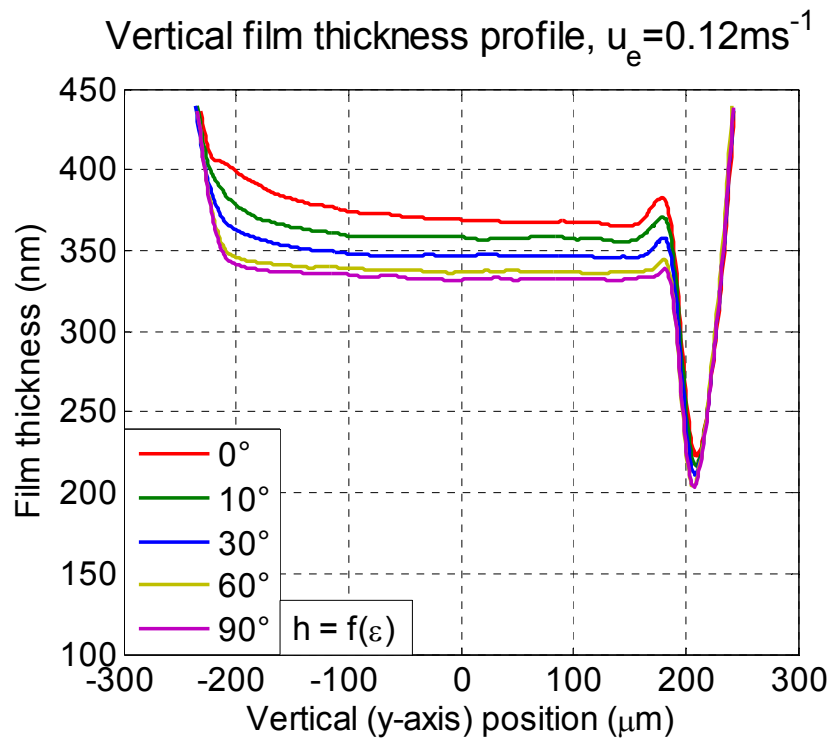
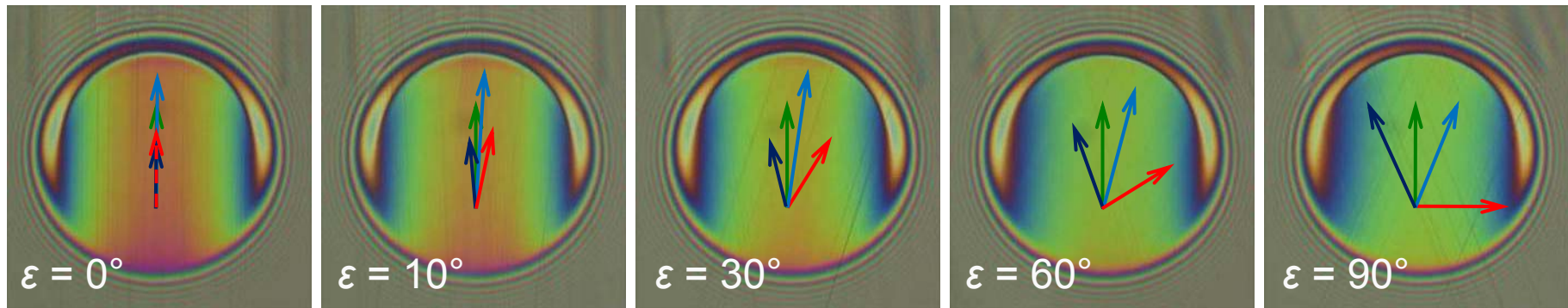


Resulting parameters

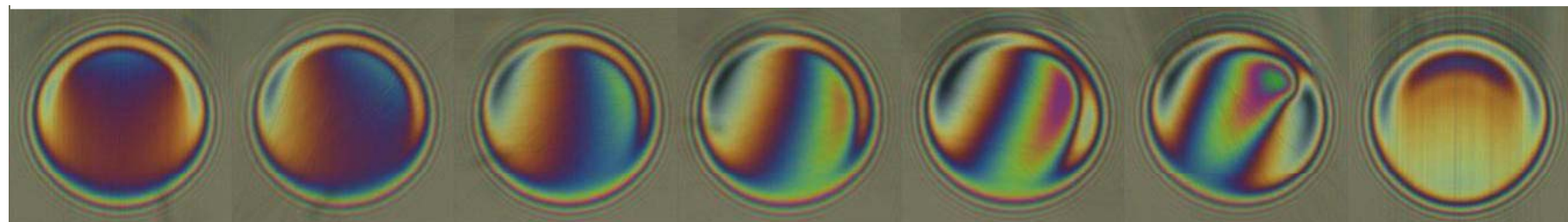
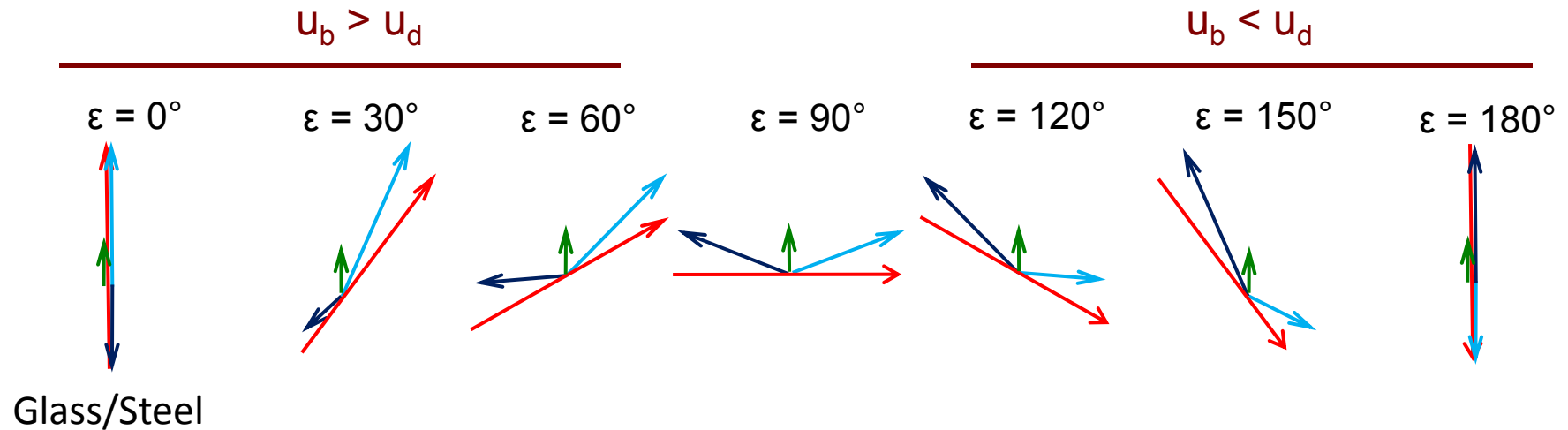
- $|u_e|$
- $|u_s|$
- ϵ

- $\delta = 0 \div 45^\circ, 135 \div 180^\circ$
- $\epsilon = 0 \div 180^\circ$
- $u_s/u_e = 0.83; 4.83$

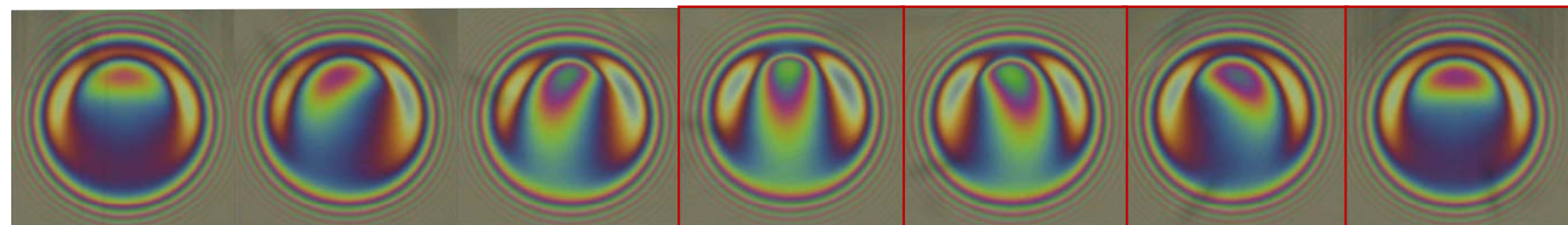
Results: LSC Glass/Steel $u_e = 0.12 \text{ ms}^{-1}$



Results: HSC $u_e = 0.12 \text{ ms}^{-1}$



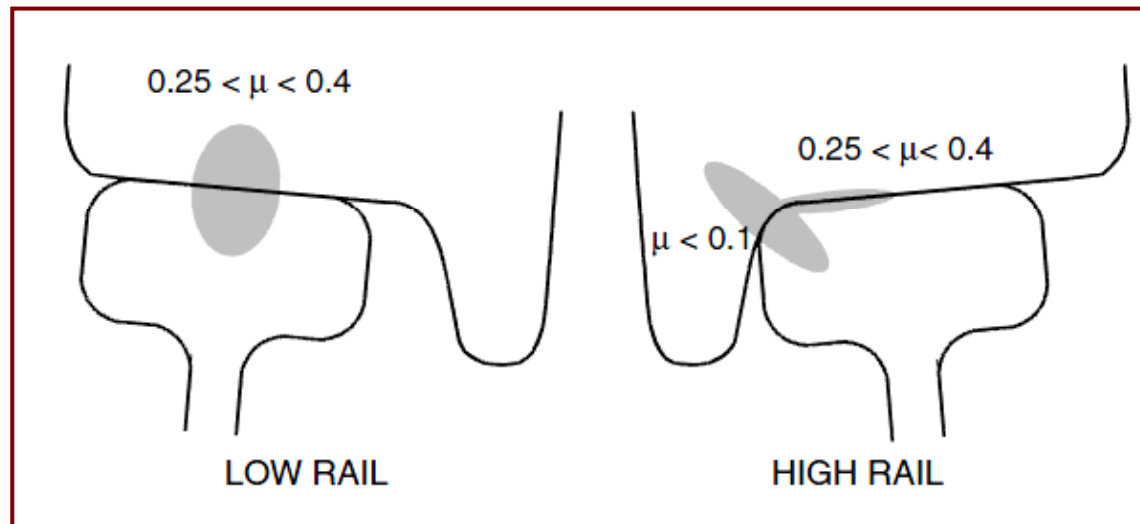
Sapphire/Steel



Wheel – rail interface

Wheel – rail contact

- Traction;
- Friction and wear;
- Contact fatigue;
- Profiles;
- Acoustic emission.



Sanding

Low adhesion problems

- crossings of platform and signals;
- delays under unfavorable conditions;
- long braking distance in emergencies.
- **Annual costs associated with poor adhesion on British railways - £ 50 million.**



Sanding

Problems associated with sanding

- higher costs;
- higher wear;
- higher dust level (tramway);
- problems with the activation of track circuits and functions of switches and crossings.



Optimalization



Lubrication

High friction problems

- increased flange and rail wear - the need for wheel reprofiling;
- lower efficiency of railway transport;
- higher noise level.
- Reduction of wear by up to 98% with the 17 g of lubricant to 1000 rpm. (SJ).



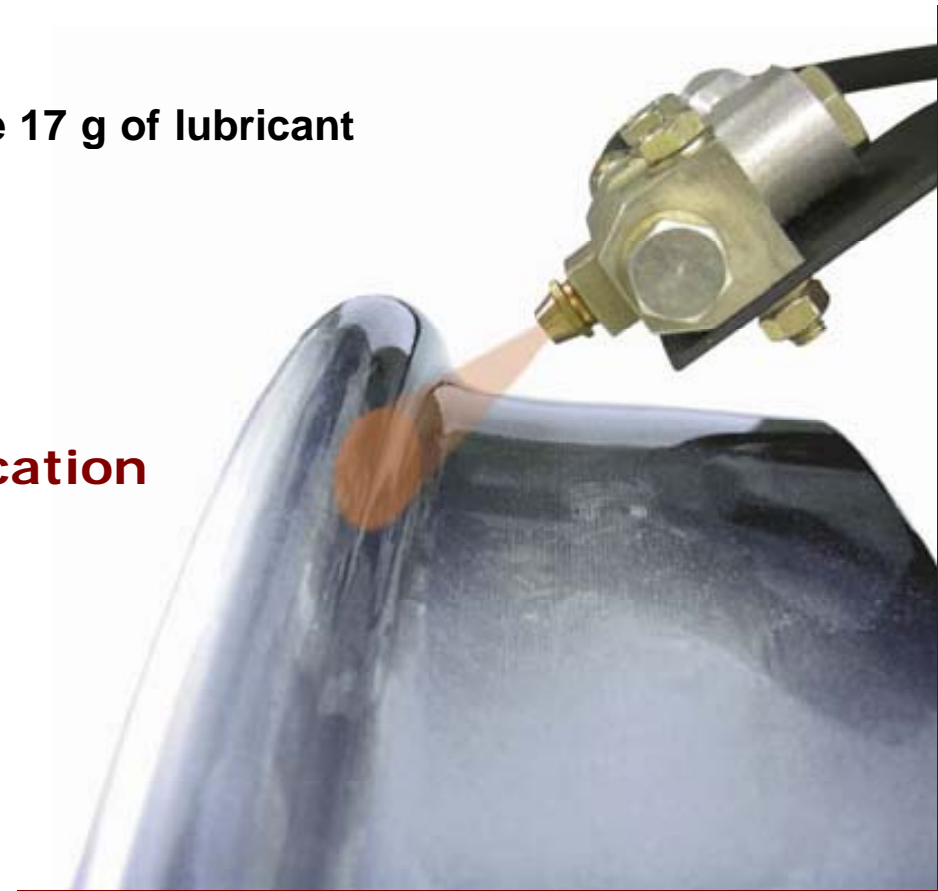
Wheel flange lubrication

Problems associated with lubrication

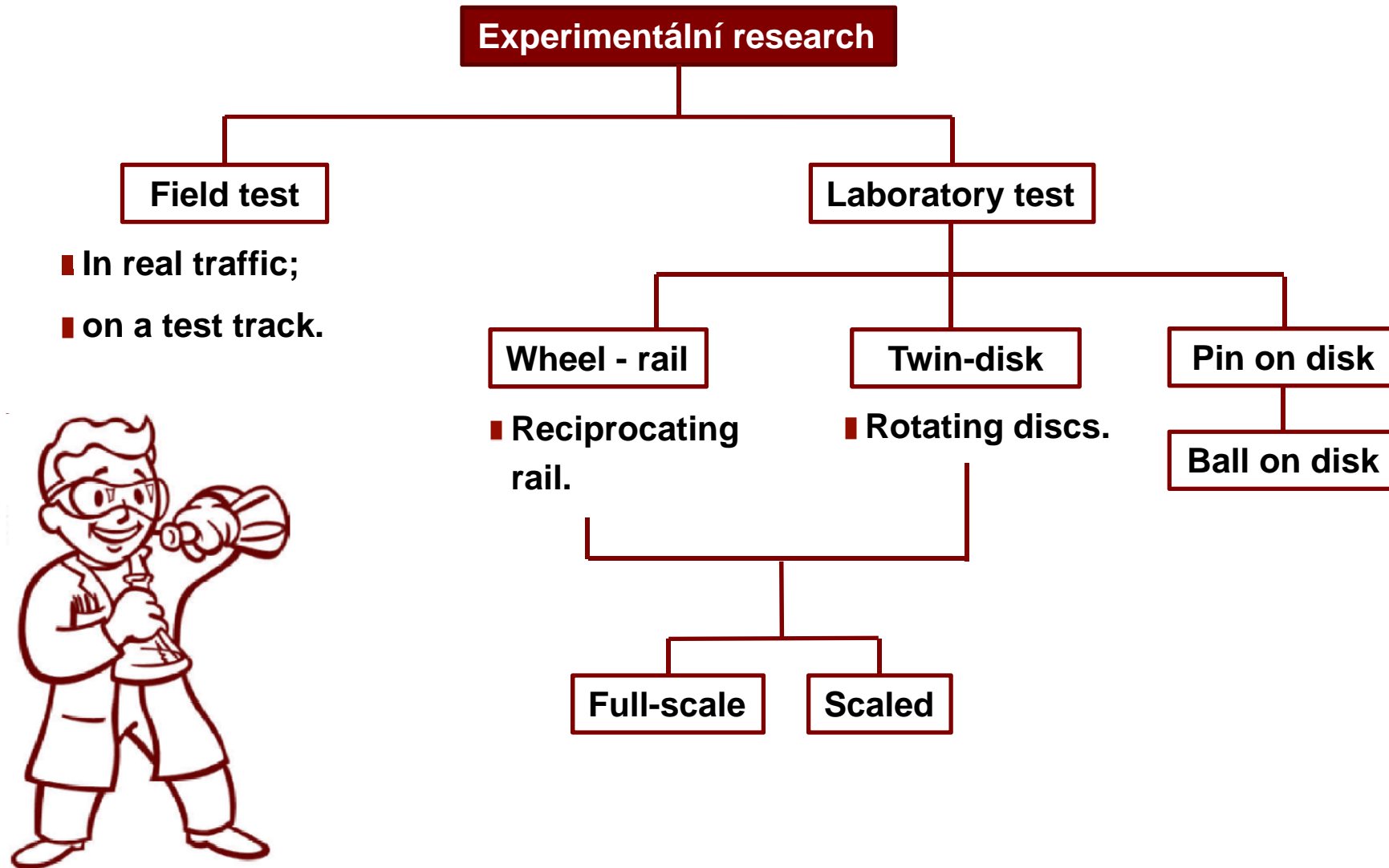
- higher costs;
- lower rail head adhesion;
- environment contamination;



Optimalization

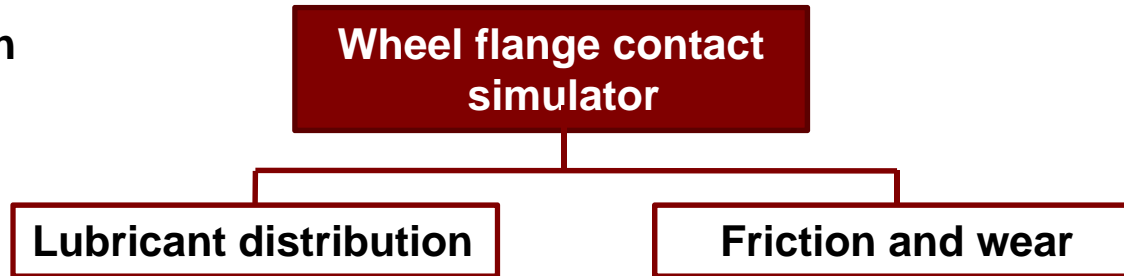


Wheel – rail interface research

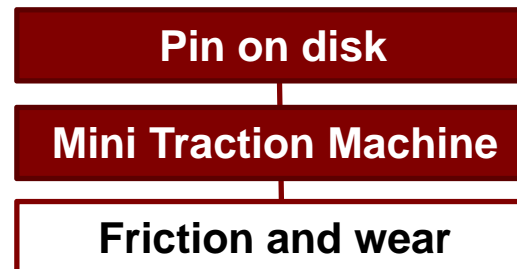
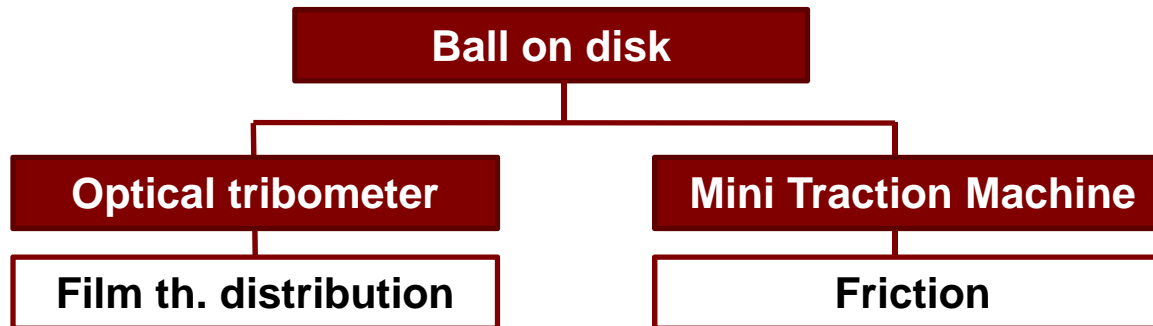


Wheel – rail interface research - Lubrication

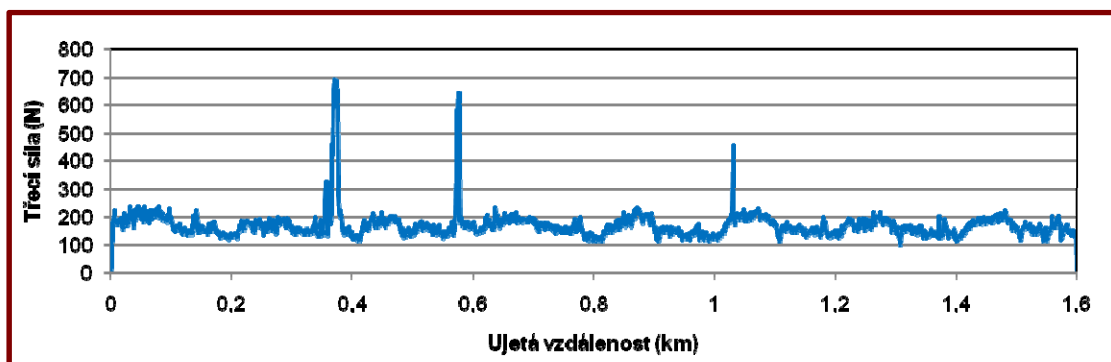
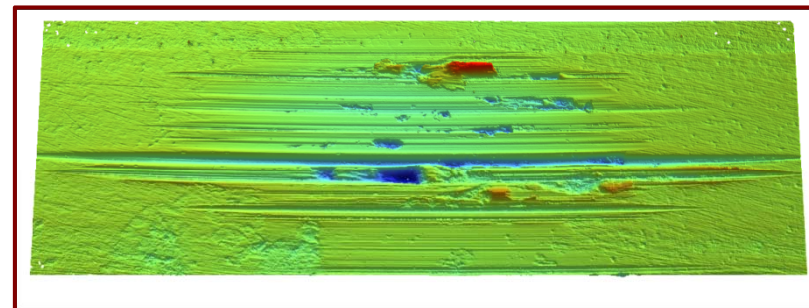
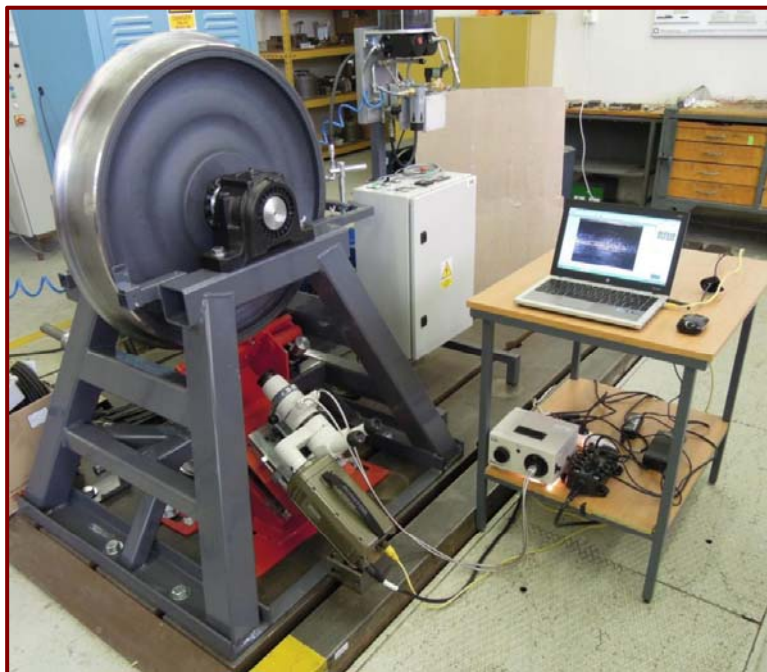
Full scale simulation



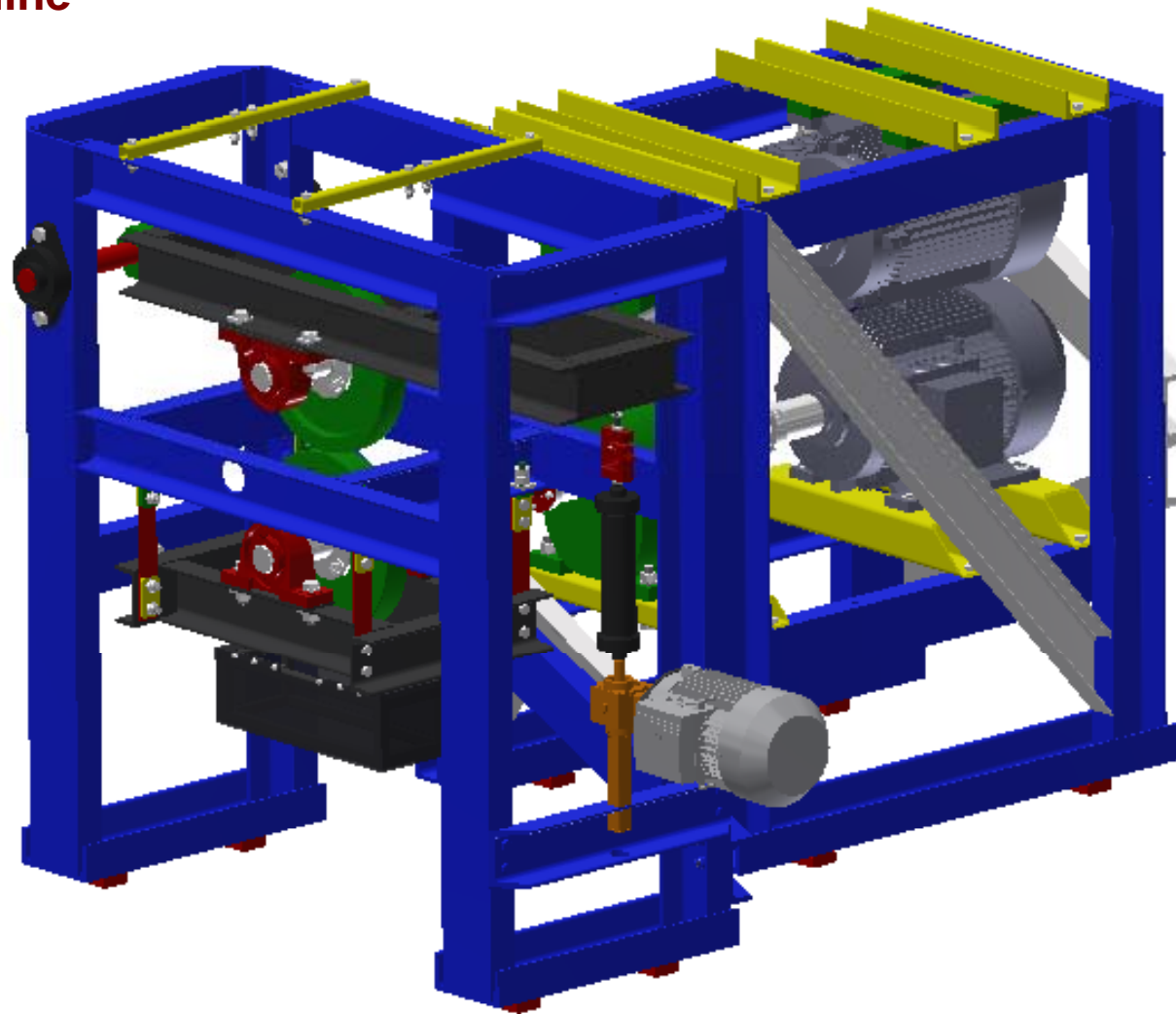
Scaled simulation



Wheel flange contact simulator



Twin disk machine



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